Vestnik zoologii, **51**(5): 401–406, 2017
DOI 10.1515/vzoo-2017-0047

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UDC 595.422

PECULIARITIES OF DISTRIBUTION OF TWO *AMBLYDROMELLA* SPECIES (PHYTOSEIIDAE, PARASITIFORMES) IN THE ZONE OF THEIR NATURAL INTERGRADATION IN THE EASTERN UKRAINE

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Peculiarities of Distribution of Two *Amblydromella* Species (Phytoseiidae, Parasitiformes) in the Zone of Their Natural Intergradation in the Eastern Ukraine. Kolodochka, L. A., Bondarev, V. Yu. — Distribution of two morphologically and ecologically related species of predatory phytoseiid mites of the genus *Amblydromella* (*A. pirianykae* and *A. recki*) in a zone of their natural intergradation (mountain ridge Donetsky Kriazh in the east of Ukraine) is studied for the first time. The list of plants populated by both predators is given. Consistent patterns of mite distribution on life forms of plants are determined biotopical fidelity on the basis of the coefficient. Very rarely, *A. pirianykae* and *A. recki* mites simultaneously populate the same plant organism (only 1.6 % of all samples) which can be attributed to the partially resolved antagonistic relationships. The basis of the antagonism is, in the first place, similarity of food preferences of the predators that, in principle, occupy the same ecological niche. Dramatic finale of this confrontation is the elimination of one of the species which has no distinct advantage in the specific conditions of a local microhabitat.
Key words: Phytoseiidae, related species, intergradation, Eastern Ukraine.

Introduction

Predatory mites of the family Phytoseiidae due to their economic importance as natural enemies of small arthropods harmful to plants have for a long while attracted the scientists' attention. Studies of phytoseiid mites of the East of Ukraine have, in essence, just begun (Kolodochka, Bondarev, 2014, 2015).

Analysis of material collected on plants of the Donetsk, Luhansk and south of Kharkiv Regions revealed two closely related species of the *rhenana* group of genus *Amblydromella* Muma: *Amblydromella* (s. str.) *pirianykae* (Wainstein, 1972), and *A.* (s. str.) *recki* (Wainstein, 1958).

Both species mostly populate herbaceous plants, rarely trees and shrubs, though the former species is also found in rodent nests. *A. pirianykae* mites are found in Germany, Moldova and Slovakia, in Ukraine they are found in the Crimea, wood-and-steppe zone, and in steppe near the coast of the Black Sea (once). *A. recki* is widely distributed in Mediterranean subregion of Palaearctica, in particular in Middle Asia and South-Western Europe. In Ukraine this species is mostly found in steppe areas; one find is registered in Kyiv suburbs (at the edge of the zones of wood-and-steppe and mixed forest) (Kolodochka, 2006).

This work presents new data on the distribution of these two predatory mite species in the eastern part of Ukraine. This is the first research of species relationship of morphologically and ecologically similar phytoseiid mites in the zone of their intergradation.

Material and methods

Material for this research was collected by authors in 2010–2013 in plant coenoses of Eastern Ukraine. The mites were shaken off on black paper and picked up with moistened dissecting needle into vials with 70 % ethanol. The mites were then mounted on slides in Hoyer liquid. In total 570 samples were taken from 87 plant

species, resulting in 1791 phytoseiid mites. The samples were collected in various protected and anthropogenized territories of Lugansk, Donetsk and Kharkiv Regions: Lugansk City (1), vil. Stanitsa Luganska (2), vil. Gerasimovka (Stanichno-Lugansky District) (3), the tract Baranii Lby (Novoaidarsky District) (4), vil. Melovatka (Svatovsky District) (5), vil. Troitske (Troitsky District) (6), vil. Belovodsk (7), reserve "Yunitsky" (Belovodskiy District) (8), vil. Nagolno-Tarasivka (9), vil. Kuriache (Sverdlovsky District) (10), vil. Chervona Polyana (11), vil. Zapolne (Antratsyt District) (12), the tract "Ploskaya balka" (13), vil. Bile, (Lutuginsky District) (14), vil. Zhovte (Slavianoserbsky District) (15), vil. Bondarevka (Markovski District) (16), vil. Nikolske (17), vil. Streltsovka (Melovskoy District) (18), Luhansk Nature Reserve "Provalsky Step" (Sverdlovsk Region) (19), Ukrainian steppe natural reserve (hereinafter USNR) "Khomutovsky step" (20) and Regional Landscape Park (hereinafter RLP) "Meotida" (Novoazovsky District) (21), RLP "Donetsky Kriazh" (22) and RLP "Zuevsky" (Shakhtersky District) (23), RLP "Kleban Byk" (24), USNR "Melova Flora» (25), vil. Piskunovo (26), RLP "Kramatorsky" (27), National Natural Park "Sviati Gory" (28) and vil. Bogorodichne (Constantynovsky District) (29), Yenakiyevo city (30) and Svetlodarsk city (Yasinovatsky District) (31), The branch of USNR "Kalmiuske" (Telmanovsky district (32), The reserve "Velikoanodolsky Lis" (Volnovakhsky District) (33), vil. Dovge (Izumsky District) (34). In statistical analysis, occurrence index (P_1, %) (Chernov, 1975) and fidelity index (Fij) (Pesenko, 1982) were used.

Results

Amblydromella pirianykae and *A. recki* are quite common on plants in Eastern Ukraine and constitute a significant part of all collected phytoseiid mites. Their distribution on the studied area appears to follow some patterns that were revealed in analysis. The colored dots map out the mites' distribution according to the degree of probability of detecting them on plants of the studied area (fig. 1). Monochromatic dots mark the findings of only one of the two species per biotope. Bicolor dots indicate that both species were collected in the biotope in varying proportions.

Biotopes inhabited by these mite species can be divided into three groups. The first group includes biotopes where only *A. pirianykae* was found. The second includes those inhabited only by *A. recki* mites. The third group comprises habitats in which both species were found. It should be noted that the presence of both species in the same biotope is not always indicative of their co-habitation on the same plant specimen.

Dots of the first group (blue) indicate the fidelity of *A. pirianykae* to mesophytic habitats on the studied area, such as floodplain and ravine woods, flood-meadows, etc. Dots of the second group (yellow) indicate the preference of *A. recki* of xerophytic habitats, such as rocky and psammophytic steppe areas with outcrops of chalk deposits etc. Third group (bicolor dots on fig. 1) shows the finds of both *A. pirianykae* and *A. recki* in the same biotope. Dots of the third group are most condensed at Donetsky Kriazh where values of the occurrence index of these species are approximately equal. This is caused by ridge's complex terrain, various (sometimes contrasting) temperature and humidity conditions and, as a consequence, mosaic distribution of mesophytic and xerophytic areas. Hence, Donetsky Kriazh becomes a distinct zone of natural intergradation of the two related species.

The probability of finding *A. pirianykae* is higher in wetter northern spurs of Donetsky Kriazh and *A. recki* mites are more likely to be found in the dry southern spurs. This is indicative of the high fidelity of the studied species to habitats characterized by different humidity. It should be noted that in case of co-habitation there are some fluctuations in occurrence index values explained by presence microbiotopes dominated by *A. recki* in biotopes dominated by *A. pirianykae* and vice versa.

The plant species inhabited by representatives of the genus *Amblydromella* on the studied area are given in table 1.

According to table 1, *A. pirianykae* and *A. recki* largely dwell in herbaceous layer since they prefer to inhabit herbaceous plants (79 % of all studied plant species diversity), while trees and shrubs constitute only 21 %. This is also supported by the species-specific values of fidelity index of the predators, which are the highest for herbaceous plants for both mite species.

The parameters characterizing the distribution of both mite species depending on plant life forms are in detail given in table 2.

Species composition of plants populated by the mite species accounts for 51 % of all surveyed plant species (trees, shrubs, herbs). The ratio of herbaceous species including those inhabited by only one of the two phytoseiid species and those which may be inhabited by both *A. pirianykae* and *A. recki* (sometimes on the same plant) is 54 % of all herbaceous species. Herbaceous plant species inhabited by one phytoseiid species (namely, *A. pirianykae*) is 22 % of all herbaceous plant species. Interestingly, *A. recki* colonizes com-

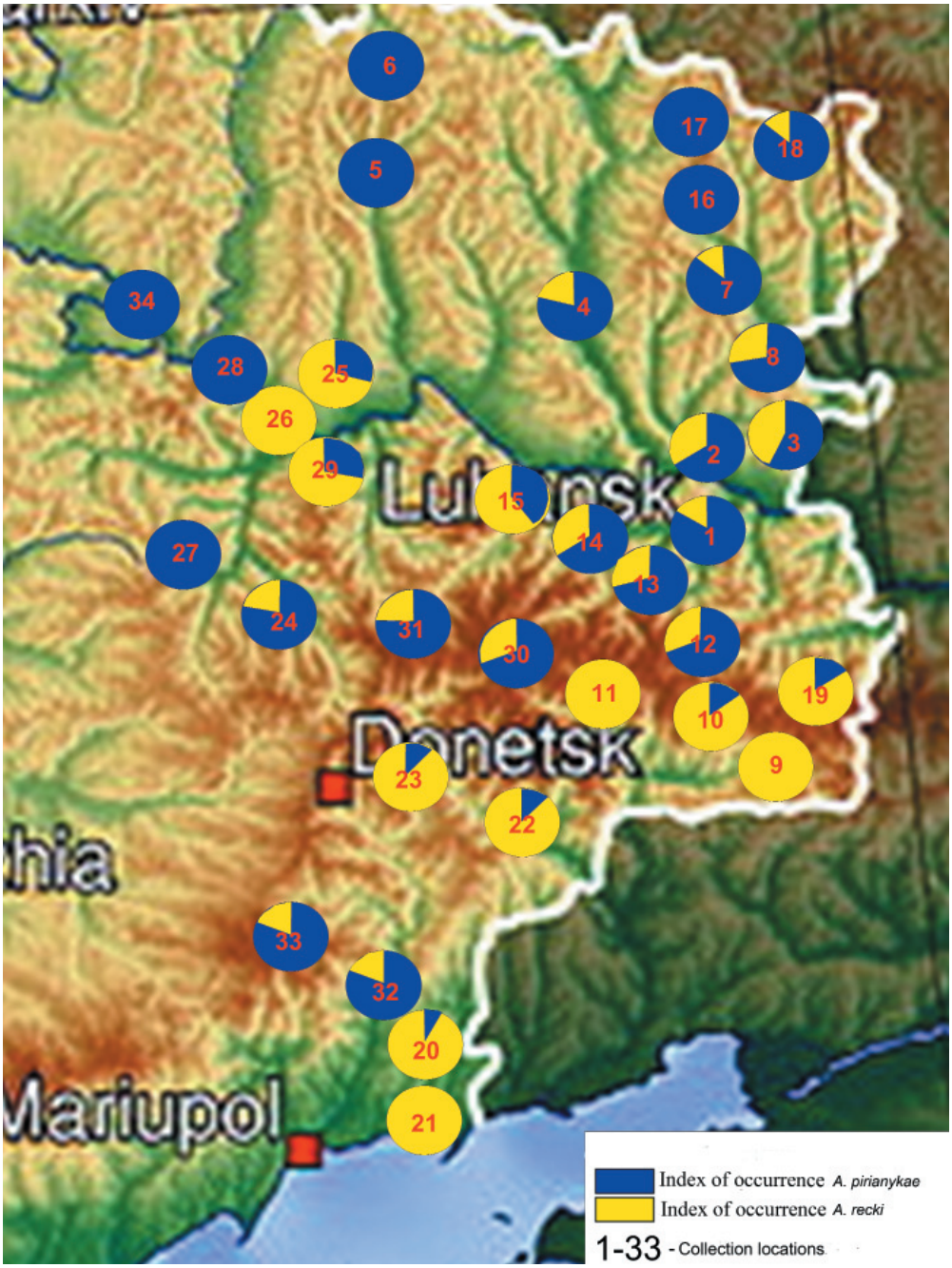

Fig. 1. Distribution of two species of the genus *Amblydromella* in the Eastern Ukraine.

Table 1. Biotopic fidelity (Fij) of two relative species of the genus *Amblydromella*

Plant species	Fij for *A. pirianykae*	Fij for *A. recki*	Plant species	Fij for *A. pirianykae*	Fij for *A. recki*
Plants inhabited only by *A. pirianykae* mites			Plants inhabited only by *A. recki* mites		
Lamium sp.	0.604	–	*Asparagus officinalis*	–	0.637
Heracleum sosnowskyi	0.604	–	*Lotus ucrainicus*	–	0.637
Limonium donetzicum	0.603	–	*Leontopodium* sp.	–	0.631
Chamerion angustifolium	0.603	–	*Poa* sp.	–	0.631
Anchusa sp.	0.603	–	*Papaver* sp.	–	0.631
Alcea rosea	0.504	–	*Medicago* sp.	–	0.631
Lamium album	0.422	–	*Tragopogon* sp.	–	0.631
Atriplex patula	0.337	–	*Sideriti* sp.	–	0.631
Centaurea carbonata	0.337	–	*Centaurea solstitialis*	–	0.631
Stachys officinalis	0.337	–	*Centaurea jacea*	–	0.631
Amaranthus sp.	0.337	–	*Cirsium canum*	–	0.631
Ambrosia sp.	0.235	–	*Helichrysum* sp.	–	0.631
Berteroa incana	0.146	–	*Ballota* sp.	–	0.501
Lonicer sp.	0.146	–	*Morus* sp.	–	0.384
Plantago lanceolata	0.047	–	*Helichrysum arenarium*	–	0.384
Corylus avellana	–0.198	–	*Campanula* sp.	–	0.384
Phragmites australis	–0.199	–	*Coronilla varia*	–	0.384
Acer campestre	–0.428	–	*Astragalus*	–	0.384
Cotinus coggygria	–0.428	–	*Robinia pseudoacacia*	–	0.199
Quercus robur	–0.717	–	*Salix alba*	–	0.124
			Pinus nigra	–	0.075
			Leymus sabulosus	–	–0.055
Plants inhabited by *A. pirianykae* and *A. recki* mites					
Artemisia pontica	0.497	0.033	*Carduus crispus*[2]	0.218	0.421
Sonchus sp.	0.488	–0.221	*Phlomis pungens*	0.206	0.441
Verbascum thapsus	0.482	0.149	*Agrimonia eupatoria*	0.178	0.457
Tanacetum vulgare	0.464	0.201	*Marrubium praecox*	0.149	0.483
Stachys transsilvanica	0.459	0.199	*Cyclachaena xanthiifolia*	0.146	0.199
Senecio vulgaris	0.422	0.201	*Galatella* sp.	0.072	0.442
Urtica dioica[2]	0.419	–0.055	*Rosa* sp.	0.047	–0.102
Achillea millefolium[2]	0.409	0.333	*Onopordum acanthium*	0.047	0.425
Salvia tesquicola	0.402	0.263	*Leonurus* sp.	0.046	0.351
Echium vulgare	0.375	0.249	*Lavatera* sp.	0.003	0.384
Centaurea sp.	0.342	0.259	*Eryngium* sp.	0.003	0.544
Centaurea diffusa	0.341	0.388	Mentha piperita	0.003	0.384
Teucrium polium	0.338	0.385	*Echinops sphaerocephalus*	0.003	0.057
Hippophaë rhamnoides	0.337	0.384	*Caragana* sp.	0.003	0.057
Origanum vulgare	0.337	0.384	*Arctium lappa*	–0.037	–0.491
Althaea officinalis	0.337	0.384	*Rhinanthus* sp.	–0.109	0.568
Inula britannica	0.286	0.335	*Salvia sclarea*	–0.271	0.442
Cichorium intybus	0.243	–0.087	*Ulmus laevis*	–0.332	–0.283
Barbarea vulgaris	0.235	0.286	*Pyrus* sp.[2]	–0.459	–0.459
Veronica sp.	0.235	0.286	*Prunus spinosa*	–0.556	–0.513
Artemisia absinthium[2]	0.234	0.157	*Malus* sp.	–0.651	–0.167
Phlomis tuberosa[2]	0.225	0.339	*Crataegus* sp.	–0.775	–0.753
			Acer tataricum	–0.793	–1.000[1]

[1] The plant species are arranged in descending order of fidelity index values (Fij); [2] both mite species are found in the same sample.

Table 2. Ratios of plant species, inhabited by *A. pirianykae* and *A. recki*

Life form	Plant species and percentage of all species of the each life form			Total number of plant species per each life form
	Inhabited by *A. pirianykae* + *A. recki*	Inhabited by *A. pirianykae*	Inhabited by *A. recki*	
Herbs	37 (54 %)	15 (22 %)	17 (24 %)	69 (100 %)
Trees and shrubs	7 (39 %)	6 (33 %)	5 (28 %)	18 (100 %)
Total	44 (51 %)	21 (24 %)	22 (25 %)	87 (100 %)

pletely different plant species compared to *A. pirianykae*, and it constitutes 24 % of all studied herbaceous diversity.

Of all studied plant species of trees and shrubs (100 %), 39 % are populated by two mite species, 33 % preferred only by *A. pirianykae,* and 28 % by *A. recki* accordingly.

According to the results, *A. pirianykae* and *A. recki* hardly ever are found together in a sample (1.6 % of all samples collected on herbs, trees and shrubs). The predators were co-habiting the same plant only in 8 % of all herbs and 5 % of all trees and shrubs.

Conclusion

This is the first study of the spatial distribution of two phytoseiid species (*Amblydromella pirianykae* and *A. recki*, morphologically and ecologically quite similar) of predatory mites in their zone of natural intergradation. In Ukraine, the former species is distributed in the wood-and-steppe zone, the other is common in the steppe zone. Analytical studies have confirmed that both species prefer to inhabit the perennial or annual herbaceous plants, i.e. they are primarily grass-dwelling. The diets of both species have not been studied. Generally they are assumed acariphagous predators.

The species-specific hygrothermal preferences are expressed in different relation of these closely related mite species to external abiotic conditions. *A. pirianykae* appears to be mesophilic and *A. recki* is more xerophilic. This in essence determines their distribution in biotopes of the studied area of eastern regions of Ukraine, most clearly in the zone of intergradation in the microbiotope-rich landscape (Donetsky Kriazh is characterized by quite complex relief).

It would be reasonable to assume that the two species are different not only in hygrothermal preferences but also in their biological potentials, fecundity, survival, voracity etc. Thus the predators are able to co-exist in the zone of their intergradation and find the most suitable sets of optimal conditions to reach the possible limits of equilibrium of maintaining the size of their populations without confrontations. Of course, species specificity of the fidelity indices is also of certain significance, allowing each of the species of predatory mites to not just choose a preferred plant habitat, but also to do so in acceptable conditions of specific microhabitats.

Very rarely, *A. pirianykae* and *A. recki* mites simultaneously populate the same specimen of plant (only 1.6 % of all samples) which can be attributed to the partially resolved antagonistic relationships. The basis of the antagonism is, in the first place, similarity of food preferences of the predators that, in principle, occupy the same ecological niche. Dramatic finale of this confrontation is the elimination of one of the species which has no distinct advantage in the specific conditions of a local microhabitat.

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Received 17 February 2017
Accepted 23 May 2017